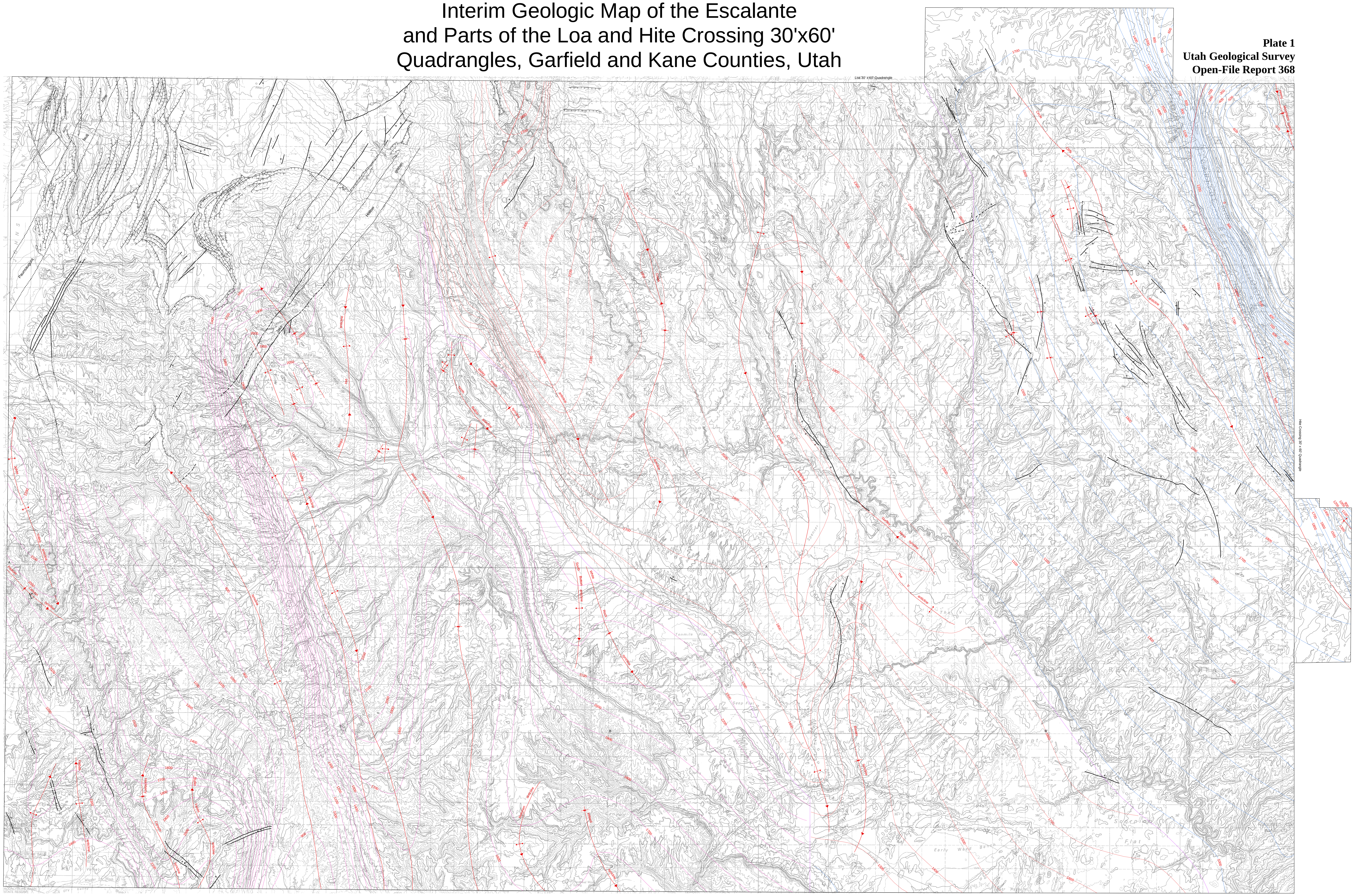
Interim Geologic Map of the Escalante and Parts of the Loa and Hite Crossing 30'x60' Quadrangles, Garfield and Kane Counties, Utah

Plate 1
Utah Geological Survey
Open-File Report 368



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by
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Utah Geological Survey
1999

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UTAH GEOLOGICAL SURVEY
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Utah Department of Natural Resources

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Utah Geological Survey
a division of
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Geologic Map Sources for Escalante and parts of Loa and Hite Crossing 30'x60' Quadrangles

Source map areas shown on figure. All maps were somewhat modified to reduce the geology to the 1:100,000 scale. The compilers mapped the Drip Tank and John Henry Members of the Straight Cliffs Formation and the upper and lower Wahweap members in the areas of maps 2-6 and maps 20-23; mapped the Winsor Member and Paria River Members of the Carmel Formation in the areas of maps 13, 14, 19, 23, and 24; modified map area 17 by separating out the Page Sandstone from the Navajo and Carmel Formations; and extensively revised surficial colluvial and mass-movement deposits in map areas 11 and 18 through photogeologic and field mapping.

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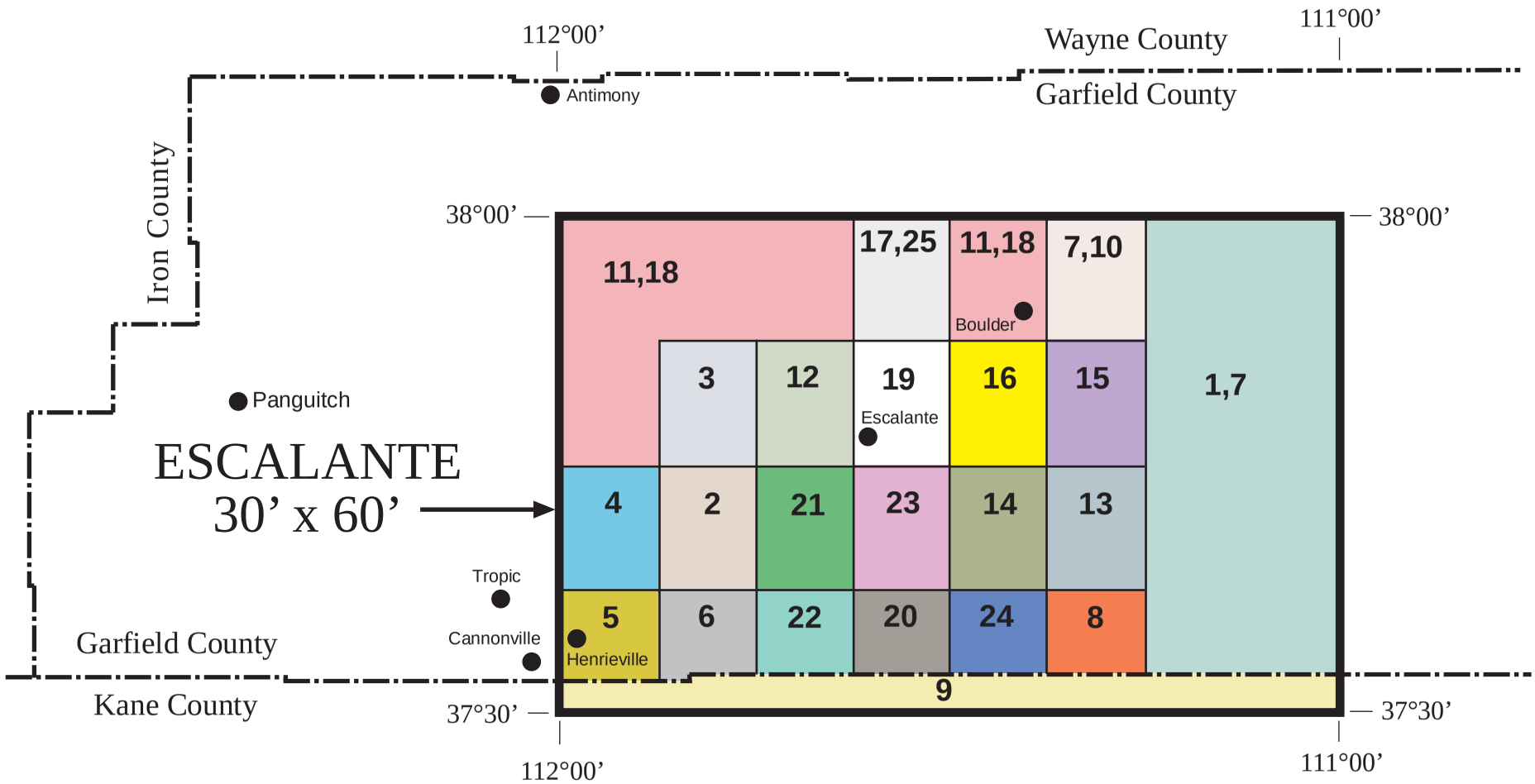


Index to the Sources of Mapping in the Escalante 30’ x 60’ Quadrangle

Escalante and parts of Loa and Hite Crossing 30'x60' Quadrangles

Description of Map Units

Quaternary

Alluvial Deposits

Qa **Alluvium, undifferentiated** -- Gravel, sand, silt, and clay in poorly to moderately sorted and stratified deposits along most drainages; clast size and composition varies from drainage to drainage and is dependent on the nature of local bedrock; is dominantly ephemeral stream deposits, but commonly includes varying amounts of debris flow deposits, eolian sand and silt, colluvium, low-level alluvial terrace deposits, alluvial-fan deposits, and floodplain deposits too small to be mapped separately at this scale; 1.5 to 9 meters (5-30 ft) thick in most drainages, may be thicker in Johns Valley.

Qafp **Floodplain alluvium** -- Silt, fine-sand, pebbles, and local boulder gravel deposited by meandering streams and rivers in low-gradient areas; generally moderately to well sorted; floodplain deposits of small areal extent included in general alluvial deposits (Qa); typically up to 5 meters (15 ft) thick; may overlie and include thick valley fill in Johns Valley.

Qat_1 **Level 1 alluvial terrace deposits**
Qat_2 **Level 2 alluvial terrace deposits**
Qat_3 **Level 3 alluvial terrace deposits**
-- Remnants of stream and pediment-mantle alluvial deposits preserved as remnants above present stream levels; similar in composition to alluvium (Qa) described above, but generally with larger percentage of bouldery clasts; composition varies from dominantly volcanic-derived to dominantly quartzite, sandstone, or limestone -- dependent on local source; commonly includes eolian silt and sand and pedogenic carbonate in upper part of deposits which gradually accumulates over time such that older deposits have thicker accumulations; in general, older deposits are preserved at higher levels above current larger stream valleys -- level 1 deposits are generally 6 to 18 meters (20-60 ft) above larger, well-graded modern streams; level 2 are 18 to 50 meters (55-150 ft) above modern streams; and level 3 are over 50 meters (150 ft) with some as much as 400 meters (1,400 ft) above modern streams (relative elevations vary across the area and some exceptions exist due to local geologic factors); highest-level deposits may be Pliocene (late-Tertiary) in age, but no definitive ages exist; 0 to 15 meters (0-50 ft) thick.

Qaf **Alluvial-fan deposits** -- Poorly to moderately well sorted sand, silt, clay, and gravel; deposited at the mouths of canyons and washes where gradients decrease; commonly includes boulders up to a few meters in diameter near the mouths of canyons; decreases in clast size farther from canyon mouths; deposited by debris flows and alluvial processes; generally form fan-shaped deposits; compositon reflects local source materials; generally less than 15 meters (50 ft) thick, but locally may be as much as 30 meters (100 ft) thick.

Qato **Volcanic gravel outwash** -- Poorly to moderately sorted gravel and boulders; may be reworked from Pleistocene glacial deposits; mapped only in Boulder Creek drainage; includes some low- to intermediate-level alluvial terrace deposits; up to 40 meters (120 ft) thick.

Eolian Deposits

Qes **Windblown sand deposits**

Qed **Windblown sand dune deposits**

-- Fine to very-fine grains of quartz and minor silt; generally overlying Jurassic sandstones (primarily Navajo and Entrada Sandstones) and locally overlying Cretaceous sandstones; form thin sheets and small dunes; local larger dune areas mapped as Qed; Up to 9 meters (30 ft) thick.

Qem **Windblown silt deposits in mounds** -- Grayish-brown silt, sand, and angular volcanic pebbles deposited by wind in evenly spaced mounds in treeless areas on the Escalante Mountains; up to 1 meter (3 ft) thick.

Mixed-Environment Deposits

Qea **Eolian and alluvial deposits** -- Moderately to moderately well sorted sands, silt, small angular to subangular rock fragments,pebbles, and cobbles; deposited as sheetwash alluvium and windblown material that is slightly to moderately reworked in part by water; occur on broad surfaces and covers the bedrock from which much of the material is derived; locally buries or partly buries coarser gravel deposits (terrace or pediment-mantle deposits); many deposits are relatively older as identified by a thin to thick pedogenic carbonate (caliche); mostly less than 7.5 meters (25 ft) thick, a few as much as 15 meters (50 ft) thick.

Qav **Volcanic debris-flow and alluvial deposits** -- Very poorly to moderately sorted, rounded boulders of basalt, basaltic andesite, and latite as large as 2 meters (6 ft) in average diameter in a sandy, silty matrix; deposited by debris flows and streams in steeper canyons; similar to alluvial (Qa) deposits but dominated by coarser debris flow materials; locally includes low-level alluvial terrace deposits; up to 20 meters (60 feet) thick; may locally be up to 80 meters (240 feet) thick.

Mass-Movement Deposits

The Escalante quadrangle contains a wide variety of mass-movement deposits, including colluvium, talus, and landslide deposits. Landslide deposits include large slump masses, sheet-slides, lobate slides, and locally may include debris-flow deposits. (Most debris-flow deposits are included in alluvial units.) Most landslide deposits are not differentiated by type on this map. Extensive landslides on the flanks of the Escalante Mountains are differentiated on this map following the mapping of Williams (1985), with some modifications by the compilers.

Qc **Colluvial deposits**

Qcv **Volcanic colluvial deposits**

-- Poorly sorted, subangular to subrounded, pebble- to boulder-sized clasts in a silty to sandy matrix; generally mantles low to moderate slopes, especially slopes with a northern aspect; mapped as mixed lithology (mostly limestone, sandstone, and quartzite) (Qc) or as dominantly volcanic clasts (Qcv); locally includes varying amounts of alluvial stream, slope wash, rock-slide, rockfall, and eolian deposits; includes active and older inactive deposits that have been isolated by downcutting streams and washes; surfaces of older deposits are typically mantled by a thin cover of eolian silt and sand; deposits commonly migrate slowly downslope through slope-creep processes; as much as 30 meters (100 ft) thick.

Qmt **Talus deposits** -- Fallen, angular blocks that have accumulated at the base of steep slopes and cliffs; generally contain minor fine-grained matrix; composition and size of materials dependent on source bedrock; blocks are typically up to 3 meters (9 ft) in diameter but locally includes blocks in excess of 10 meters (30 ft), and locally includes slump blocks several tens of meters across; typically up to 10 meters (30 ft) thick.

Qms **Landslides and slumps, undifferentiated** -- Very poorly sorted, chaotic deposits ranging in composition from silt to large blocks several tens of meters in average diameter that moved down-slope by slumping, sheet-sliding, or flowing; upper surfaces are typically hummocky and some have closed depressions; most landslides and slumps are inactive but some show evidence of historic movement; occur in most units but most detachment surfaces are in units containing abundant bentonitic materials, including the tuffaceous sandstone unit, the Claron Formation, Tropic Shale, Morrison Formation, Carmel Formation, and Chinle Formation; locally include alluvial, colluvial, and eolian deposits; highly variable in thickness -- generally 5 to 15 meters (15-45 ft), but locally up to 100 meters (300 ft) thick.

Qmdm **Debris-slide deposits, mixed lithology**
Qmdv **Debris-slide deposits, mostly volcanic rock**
Qmdt **Debris-slide deposits, mostly tuffaceous sediments unit**
Qmdb **Debris-slide deposits, mostly Brian Head Formation**
-- Very poorly sorted boulders typically up to 10 meters (30 ft) in diameter in a sandy, silty matrix; moved downslope primarily as sheets (see general Qms description above); locally differentiated by primary involved units (Qmdt, Qmdb) , mapped as Qmdm where composed of primarily sedimentary rock or rocks of mixed lithology, or mapped as Qmdv where composed primarily of volcanic rock; typically 5 to 15 meters (15-45 ft) thick.

Qmsm **Slump deposits, mixed lithology**
Qmsv **Slump deposits, mostly volcanic rock**
Qmso **Slump deposits, mostly Osiris Tuff**
Qmsl **Slump deposits, mostly latite tuff unit**
Qmsa **Slump deposits, mostly basaltic andesite unit**
Qmst **Slump deposits, mostly tuffaceous sediments unit**
Qmsb **Slump deposits, mostly Brian Head Formation**
-- Large, intact blocks of rock that have separated from bedrock along distinct fractures and rotated back while sliding relatively short distances down-slope; slumps of mixed lithology or primarily sedimentary rocks mapped as Qmsm; slumps of more than one volcanic map unit mapped as Qmsv; Qmst has high bentonitic clay content and is primary detachment zone for many landslides; the slump complex on the west flank of the Escalante Mountains includes some slump blocks in excess of 2 km (1.2 mi) across with only minor internal deformation; this area is also complicated by the Paunsaugunt fault zone -- some mapped slump scarps may have developed along fault scarps with part of the offset due to tectonic fault movment; some large coherent slump blocks are differentiated by involved bedrock unit; contacts are highly generalized.

Qmlm **Lobate slide debris, mixed lithology**
Qmlv **Lobate slide debris, mostly volcanic rock**
-- Very poorly sorted, clay to boulder materials that primarily flowed rather than slid downslope; typically

has higher silty, sandy matrix content than sheet-slide deposits and forms hummocky, lobate mounds with lateral ridges and flanking levees; may include some debris-flow deposits; mapped as Qmlm where composed primarily of sedimentary rocks or rocks of mixed lithology; mapped as Qmlv where composed primarily of volcanic rock; 5 to 15 meters (15-45 ft), but locally may be up to 100 meters (300 ft) thick.

Quaternary - Tertiary

note: some high-level terrace deposits (Qat$_3$), described above, may be Pliocene in age, but no definitive ages exist

QTb **Basalt (Pleistocene or Pliocene)** -- Dark-gray, olivine-clinopyroxene-labradorite basalt in thin flows; commonly weathers to blocks; less than 61 meters (200 ft) thick on Aquarius Plateau.

Tertiary

Tvs **Volcaniclastic sediments (probably Miocene)** -- Poorly to moderately sorted conglomerate, sandstone, and siltstone derived mostly from volcanic source deposits; poorly exposed; thickness 0 to 61 meters (0-200 ft).

To **Osiris Tuff (Miocene)** -- Gray, purplish-gray, and red-brown latitic ash-flow tuff; densely welded; crystal rich; 20-25 percent phenocrysts of andesine, sanidine, minor quartz, clinopyroxene, and biotite; weathers to rounded boulders; thickness 0 to 183 meters (0-600 ft); early to middle Miocene age, 22.1 ± 0.4 to 22.8 ± 0.4 (Fleck and others, 1975).

Tl **Latite (Oligocene to Miocene)** -- Dark-gray to purplish-gray, aphyric to sparsely porphyritic lava flows and minor welded ash-flow tuffs; commonly contains 5-10 percent phenocrysts of andesine, sanidine, and clinopyroxene; thickness 0 to about 180 meters (0-600 ft).

Tba **Basaltic andesite (Oligocene)** -- Dark-gray, dark-brown, and dark-red, dense to vesicular, crystal-rich, massive flows and flow breccias; contains large distinctive green augite and equant labradorite, and less common olivine phenocrysts; thickness 0 to 213 meters (0-700 ft).

Tvb **Andesite breccia (Oligocene)** -- Gray, pink, or pale-green, thick-bedded mudflow breccias; clasts contain large green hornblende crystals ;mapped only along East Fork of Sevier River where it grades laterally southward into tuffaceous sediments (Tvt) within a kilometer (0.6 mi) of the north edge of the quadrangle; in part equivalent to Bullion Canyon volcanics of Marysvale area; thickness 0 to 5 meters (0-15 ft).

Tvt **Tuffaceous sediments (Oligocene and Eocene?)** -- White, pale-brown, and red tuffaceous siltstone, shale, arkosic sandstone, and pebble conglomerate in thin-and-even to thick-and-lenticular beds; local silicified zones yield dense, red, orange, yellow, and white chalcedony; exposed in cliffs capped by massive latite or basaltic andesite; thickness 0 to 180 meters (0-600 ft).

Tbh **Brian Head Formation (Eocene)** -- Pink to red sandstone, siltstone, mudstone, and limy mudstone; slope-former; interbedded with white to gray, fine- to coarse-grained sandstone; 3- to 9-meter-thick (10- to 30-

ft) basal conglomerate contains well-rounded black chert, light quartzite, and gray limestone; thickest exposures west of Griffin Top; pinches out to east near Rogers Peak; shown as variegated sandstone member of Claron Formation on older maps; thickness 0 to 180 meters (0-600 ft), thickening northward.

Tcw **Claron Formation, white limestone member (Eocene)** -- White to light-gray limestone; very finely crystalline to microcrystalline; contains thin yellowish-gray mudstone interbeds mostly in middle and lower parts; some beds contain early to middle Eocene fresh-water gastropods; pinches out to east in upper part of North Creek; caps Table Cliff Plateau and forms vertical cliffs or steep forested slopes thickness 0 to about 180 meters (0-600 ft).

Tcp **Claron Formation, pink limestone member (Eocene-Paleocene?)** -- Pink, pale-orange, light-gray, and white limestone; commonly mottled pink or yellow, irregularly bedded to massive, very fine-grained to fine-grained; clastic; contains thin gray to red limy mudstone interbeds; locally contains lenticular fine- to coarse-grained calcareous sandstone or calcarenite and thin (0.3-2 m; 1-6 ft) dark-gray microcrystalline limestone beds that contain dark shell fragments; overall pink color of member produced by stain from interbedded red units; forms pink cliffs, columns, and spires where deeply eroded, or steep forested slopes; 0 to 274 meters (0-900 ft) thick.

unconformity?

Tph **Pine Hollow Formation (Paleocene - Eocene)** -- Purple-gray to bright red mudstone, siltstone, and claystone; mudstone is commonly arenaceous and calcareous, locally grading to light-gray or white argillaceous or silty limestone; claystone is commonly bentonitic, particularly near middle of formation. Contains interbeds of gray, tan, or red fine- to coarse-grained sandstone in lower part and thin conglomerate lenses mostly near base; generally poorly exposed; lower part intertongues with the Grand Castle Formation; thins to the north; 0 to 137 meters (0-450 ft) thick.

Tertiary - Cretaceous

TKcg **Grand Castle Formation (Paleocene) and Canaan Peak Formation (Paleocene - Maastrichtian), undivided** -- Grand Castle is boulder to pebble conglomerate and sandstone; clasts are quartzite, limestone, silicified carbonate, and minor dolostone and kaolonite; Paleozoic fossils are common in carbonate clasts; highly variable in thickness, ranging from 0 to as much as 230 meters (0-750 ft) in short distances. Canaan Peak is interbedded sandstone, conglomeratic sandstone, and conglomerate; upper part is tan, pink, or red and lower part is light-brown or gray; contains well-rounded pebbles, cobbles, and small boulders of quartzite, chert, dense to porphyritic igneous rocks, and some gray limestone; boulders may locally exceed 30 cm (12 inches) in diameter; generally forms steep gravel-covered slopes; as much as 140 meters (460 ft) thick; map unit is unconformable beneath the Claron Formation along the Johns Valley anticline and unconformable on the Kaiparowits Formation throughout the region.

unconformity

Cretaceous

Kk **Kaiparowits Formation** -- Green to brown-gray, very fine- to fine-grained, friable sandstone; contains a few thin, light-gray mudstone interbeds and buff to brown moderately resistant lenticular fine- to medium-grained sandstone interbeds; locally contains dinosaur bones, turtle shells, and fresh-water mollusks; weathers to badland topography or is poorly exposed; thins northward; base conformable and gradational with the Wahweap Formation below; 366 to 914 meters (1,200-3,000 ft) thick.

Kaiparowits Plateau area

Kw **Wahweap Formation, undivided** -- shown on cross section only.

Kwu **Upper member** -- Light-gray to white sandstone, medium to coarse-grained massive, cross-bedded, cliff-forming, grades upward into the Kaiparowits Formation; correlates in age with the Tarantula Mesa Sandstone in the Henry Mountains Basin; 76 to 152 meters (250-500 ft) thick.

Kwl **Lower member** -- Light- to dark-brown sandstone, fine- to medium-grained, cross-bedded, lenticular, with interbedded olive-gray to tan mudstone; lower part forms steep slope with local ledges and is conformable on Straight Cliffs Formation; correlates with the Masuk Shale Member of the Mancos Shale in the Henry Mountains Basin. 198 to 305 meters (650-1000 ft) thick.

Henry Mountains Basin -- Circle Cliffs area (northeast corner of map area)

Ktm **Tarantula Mesa Sandstone** -- Yellow-gray to light-brown, fine- to medium-grained sandstone with partings of platy-weathering sandstone and gray sandy mudstone; intertongues with Masuk Member of Mancos Shale below; mostly cliff forming; correlates with the upper Wahweap Formation in the Kaiparowits basin; 70 to 122 meters (230-400 ft) thick.

Mancos Shale

Kmm **Masuk Member** -- Sandy to silty, gray to olive-gray mudstone near the base interbedded with light-yellow to brown sandstone beds which increase in number and thickness upward; sandstone beds are slope-forming, friable, and thin to thick bedded with local ledges; shales become more carbonaceous higher in the section and locally coaly; correlates with lower Wahweap Formation in the Kaiparowits basin; 137 to 274 meters (450-900 ft) thick.

Straight Cliffs Formation

Ksu **Drip Tank and John Henry Members, undivided** -- shown on cross sections only.

Ksd **Drip Tank Member** -- Light-gray, gray-orange, and white sandstone, medium- to coarse-grained and locally conglomeratic, massive, cross-bedded, and cliff forming; base is reworked marine beach sand; correlates with the Muley Canyon Sandstone Member of the Mancos Shale in the Henry Mountains Basin; 61 to 122 meters (200-400 ft) thick.

Ksj **John Henry Member** -- Interbedded pale-yellow-orange, tan, and light-brown sandstone, olive-gray to tan mudstone, dark-gray to black carbonaceous mudstone, and coal; forms alternating cliffs and slopes; base may contain thin pebble conglomerate lenses and lower sandstone lenses may contain fragmentary inoceramus shells; base rests unconformably on the lower member of the Straight Cliffs Formation; contains commercial coal deposits in at least two zones--an upper or Alvey zone and a lower or Christensen-Henderson zone; correlates with the Blue Gate Shale Member of the Mancos Shale in the Henry Mountains Basin; 213 to 305 meters (700-1,000 ft) thick.

unconformity

Kmc **Muley Canyon Sandstone Member** -- Light-brown, lenticular, and cross-bedded sandstone at the top, up to 40 meters (130 ft) thick, that scours into a coal-bearing unit of interlensed sandstone, sandy shale, gray shale, carbonaceous shale, and coal, 0 to 15 meters (0-50 ft) thick, in turn overlying cliff-forming, massive, cross-bedded sandstone, that is fine to medium grained, calcareous, with thin shale or sandy shale partings; cliff forming unit is 30 to 61 meters (100-200 ft) thick and overlies a unit transitional with the Blue Gate Shale Member up to 23 meters (75 ft) thick, of interbedded gray to tan sandstone and gray shale; correlates with the Drip Tank Member of the Straight Cliffs Formation in the Kaiparowits basin; 37 to 122 meters (120-400 ft) thick.

Kmb **Blue Gate Shale Member** -- Blue-gray, finely laminated mudstone, some bentonitic clay, and limestone beds in lower two-thirds; becomes progressively sandier in upper third adding yellow-gray thin beds of calcareous sandstone toward the top; forms a fluted slope; may overlie the Ferron Sandstone Member unconformably; correlates with the coal-bearing John Henry Member of the Straight Cliffs Formation in the Kaiparowits basin; 366 to 457 meters (1,200-1,500 ft) thick.

unconformity?

Ksl **Lower member** -- Consists of the combined Smoky Hollow and underlying Tibbett Canyon Members; The Smoky Hollow Member consists of a white sandstone, medium- to very coarse grained, conglomeratic, massive, cross-bedded, and cliff-forming, 7.5 to 27 meters (25-90 ft) thick, overlying interbedded sandstone, mudstone, carbonaceous mudstone, and a few very thin impure coal beds; Tibbet Canyon Member is tan to light-brown sandstone, fine-grained, partly cross-bedded, cliff forming, and marine, is found beneath the Smoky Hollow Member, and intertongues with the Tropic Shale below; The Smoky Hollow Member is 34 to 91 meters (110-300 ft) thick; The Tibbet Canyon Member is 24 to 55 meters (80-180 ft) thick; Entire lower part is 58 to 140 meters (190-460 ft) thick.

Kt **Tropic Shale** -- Medium- to olive-gray marine shale; contains thin tan, yellowish-gray, or light-brown very fine-grained to fine-grained sandstone interbeds in upper 30 meters (100 ft) and thin beds of bentonite and fossil-bearing limestone concretions near the base; forms steep slope; 183 to 274 meters (600-900 ft) thick.

Kmf **Ferron Sandstone Member** -- Consists of three units (descending), a coal-bearing unit of interbedded lenticular sandstone, shale, carbonaceous shale and coal up to 21 meters (70 ft) thick; a cliff-forming unit of yellow-gray, tan, or brown fine- to coarse-grained sandstone that is cross-bedded, calcareous, and massive, with partings of shale or sandy shale, 18 to 61 meters (60-200 ft) thick; and an interbedded unit of gray to light-brown very fine-grained sandstone and gray sandy shale, up to 27 meters (90 ft) thick; intertongues with the Tununk Shale Member below; lower contact is placed at base of the first prominent sandstone bed; correlates with the lower part of the Straight Cliffs Formation in the Kaiparowits basin; 58 to 117 meters (190-385 ft) thick.

Kmt **Tununk Shale Member** -- Dark-gray and blue-gray thinly laminated marine shale, calcareous, locally fossiliferous; forms a slope gradational with Dakota Sandstone; contains a few thin beds of very fine-grained quartzose sandstone; correlates with the Tropic Shale to the west; 134 to 219 meters (440-720 ft) thick.

Kd **Dakota Formation** -- Gray-orange or light-brown locally fossiliferous sandstone interbedded with light-olive-gray shale in upper half, moderately resistant; coal beds locally present in the middle of formation, coal beds are mostly thin, but are locally thick; dark-brown to black carbonaceous claystone, gray shale, and siltstone, and some beds of gray-orange to white coarse-grained sandstone in the lower half; locally conglomeratic at the base; forms ledges and slopes; Upper Cretaceous in age, except for local conglomeratic channels at the base which may be Lower Cretaceous in age; conglomeratic channels are probably separated from the remainder of the formation by an unconformity; typically 24 to 61 meters (80-200 ft) thick, but locally varies from 24 to 107 meters (80-350 ft) thick.

unconformity

Jurassic

Jm **Morrison Formation** -- consists of Brushy Basin, Salt Wash, and/or Tidwell Members, which are too thin to map separately; Brushy Basin Member is variegated mudstone and claystone, minor sandstone and conglomerate; mostly slope-forming; 0 to 91 meters (0-300 ft) thick, gradually thinning westward due to unconformity; underlying Salt Wash Member is mostly ledge- and cliff-forming, gray or yellow-gray, medium- to coarse-grained sandstone and conglomerate; conglomerate contains pebbles and cobbles of red, black and gray chert, petrified wood, and quartzite; contains a few interbeds of red and green siltstone; locally uraniferous and vanadiferous in the bases of channel sandstones; 0 to 137 meters (0-450 ft) thick, varying irregularly across the quadrangle; underlying Tidwell Member is alternating thin beds of light-gray and greenish-gray, fine-grained, calcareous sandstone and moderate-red or green shale; calcareous; beds on east side of Kaiparowits Plateau mapped by previous workers as Summerville Formation are here considered part of the Tidwell Member (the Tidwell Member in the Escalante area may include thin beds of actual Summerville Formation); 0 to 55 meters (0-180 ft) thick. Sub-Dakota unconformity cuts increasingly deeper into the formation westward, and has cut out all of the Morrison Formation in the southwest corner of the quadrangle. Total Morrison Formation is 0 to 229 meters (0-750 ft) thick.

unconformity

Jes **Summerville, Curtis, and Entrada Formations, undivided** -- Mapped only in the northeast part of the map area (Circle Cliffs -Henry Mountains Basin area); Summerville is red to brown ribbed or thin-bedded siltstone and mudstone and brown to white, fine-grained sandstone; locally includes pink and white gypsum near the top, generally forms a steep slope; about 10 meters (30 ft) thick; upper part of map unit includes inter-bedded red and gray mudstone, pink and white gypsum, gray limestone and gray sandstone that is part of the Tidwell Member of the Morrison Formation; (Summerville is either missing in the Escalante-Kaiparowits area or is mapped as part of the Tidwell Member of the Morrison Formation); underlying Curtis Formation is up to 1.5 meters (5 ft) of discontinuous, ledge-forming, white, calcareous sandstone to sandy limestone that pinches out a few kilometers south of lattitude 38° N.; top of Entrada is an unconformity; the Entrada Sandstone is slope-to cliff-forming, thin- to thick-bedded, reddish-brown sandstone and siltstone in the upper and lower parts, separated by a middle silty, slope-forming unit; upper part is 52 to 76 meters (170-250 ft) thick; middle part is 97 to 110 meters (320-360 ft) thick; lower part is 64 to 111 meters (210-365 ft) thick; formation ranges from 213 to 274 meters (700-900 ft) thick.

unconformity?

Jh **Henrieville Sandstone** -- White to pale yellow, fine- to medium-grained, poorly sorted, calcareous sandstone, siltstone, claystone, and shale; contains scattered coarse grains; lower part (25 to 33% of formation) is planar-bedded siltstone, claystone, and shale of probable fluvial origin; upper part is mostly cross-bedded sandstone of eolian origin; entire unit forms cliff or steep slope; present only in the Tropic Ampitheater (SW corner of Escalante 30'x60' and SE corner of Panguitch 30'x60' quadrangle); may correlate with part of the Escalante Member of the Entrada Sandstone or with the Salt Wash Member of the Morrison Formation; 0 to 70 meters (0-230 ft) thick.

Je **Entrada Sandstone** -- Generally consists of upper, middle, and lower members that are not mapped separately; upper (Escalante Member) consists of 24 to 122 meters (80-400 ft) of white, light-gray, pale-orange, and yellow-brown, fine- to coarse-grained, massive, high-angle cross-bedded, cliff-forming sandstone; the middle (Cannonville Member) consists chiefly of 61 to 128 meters (200-420 ft) of red-brown and gray-banded, slope-forming, silty sandstone and sandy siltstone; lower (Gunsight Butte Member) is chiefly red-brown, fine-grained, cross-bedded cliff-forming or earthy-weathering, silty sandstone 46 to 111 meters (150-365 ft) thick. Total Entrada Sandstone in the Kaiparowits area is 122 to 305 meters (400-1,000 ft) thick.

Jc **Carmel Formation** -- consists of undifferentiated Winsor and Paria River Members in areas where too thin to map separately; 61 to 168 meters (200-550 ft) thick, thinner sections to east and south; conformable with Entrada Sandstone above.

Jcw **Winsor Member** -- Chiefly red-brown siltstone, yellow-brown fine-grained sandstone, and gypsum; 15 to 46 meters (50-150 ft) thick.

Jcp **Paria River Member** -- Consists of red mudstone and sandstone capped by chippy-weathering white or pink thin-bedded limestone; 46 to 122 meters (150-400 ft) thick.

Jp **Page Sandstone and Judd Hollow Tongue of Carmel Formation, undivided** -- Consists of three unmapped units, (descending) Thousand Pockets Tongue of Page Sandstone, Judd Hollow Tongue of Carmel Formation, and Harris Wash Tongue of Page Sandstone; the Thousand Pockets Tongue is light-gray-orange, fine- to medium-grained, and cross-bedded sandstone, 0 to 24 meters (0-80 ft) thick; the Judd Hollow Tongue is chiefly red-brown siltstone or mudstone, commonly contorted fine-grained sandstone, and light-gray thinbedded limestone 0 to 34 meters (0-110 ft) thick, disappearing to the south and east; Harris Wash Tongue rests unconformably on the Navajo Sandstone and is light-gray-orange, cross-bedded, fine-grained sandstone with small chert pebbles at the base, 3 to 37 meters (10-120 ft) thick, generally thickening westward; Entire interval is 18 to 70 meters (60-230 ft) thick; the Page Sandstone is generally too thin (9 to 18 meters [30-60 ft] thick) and the contact is too difficult to map along the Circle Cliffs where the unit is included with the Navajo Sandstone, which it resembles.

unconformity

Jgc **Glen Canyon Group** -- Navajo, Kayenta, and Wingate Formations; shown on cross sections only.

Jn **Navajo Sandstone** -- Chiefly light-gray-orange, white, gray, and pink, fine- to medium-grained sandstone; cross-bedded on a large scale with very thick cross-bed sets; lower 30 meters (100 ft) are generally planar bedded; crops out as cliffs, rounded to hummocky knobs and monuments, and bare slopes; 168 to 518 meters (550-1700 ft) thick, thickening generally westward.

Jk **Kayenta Formation** -- Gray-red, dusky red, purplish-red, thin- to thick-bedded sandstone interbedded with lesser amounts of dusky-red siltstone, shale, light-yellow limestone, and intraformational conglomerate; contains some pink eolian sandstone beds near the top that show large-scale cross-bedding; forms ledges, cliffs, and a few slopes; 61 to 110 meters (200-360 ft) thick.

Jw **Wingate Sandstone** -- Orange-red, gray-red, and red-brown sandstone, fine grained, well-sorted, cross-bedded on large scale, and massive; generally crops out in vertical cliffs; around parts of the Circle Cliffs the lower part is bleached white to yellow-gray; unconformable contact with the Chinle below is abrupt, but locally the upper Chinle contains similarly colored, but planar sandstones; 61 to 122 meters (200-400 ft) thick.

unconformity

Triassic

TR **Triassic Formations** -- shown on cross sections only.

Chinle Formation

TRc **Church Rock, Owl Rock, Petrified Forest, and Monitor Butte Members, undivided** -- These upper four members are combined in mapping; in descending order: the Church Rock Member is brown to red-brown sandstone and siltstone, fine to medium grained, forms thick, blocky and cliffy beds with thin intervening slopes under the Wingate Sandstone, and is 0 to 7.5 meters (0-25 ft) thick; the Owl Rock Member is red, brown, and green-gray, ledge- and slope-forming, sandstone and green and thin gray silty limestone beds with local nonbentonitic mudstones, 46 to 76 meters (150-250 ft) thick; the Petrified Forest Member is slope-forming variegated bentonitic mudstone with a few sandstone and conglomerate beds that bear petrified wood, 46 to 107 meters (150-350 ft) thick; and the Monitor Butte Member is green and gray bentonite, bentonitic mudstone, limestone-pebble conglomerate lentils, and rippled gray to dark-gray micaceous sandstone, 30 to 61 meters (100-200 ft) thick; Total of these four members is 91 to 244 meters (300-800 ft) thick.

TRcs **Shinarump Member** -- Chiefly white, light-gray, or light-yellow, medium- to fine-grained cross-bedded sandstone with minor conglomerate beds; contains interbeds of green-gray mudstone; contains carbonaceous and charcoaly material, especially near the base; locally underlain by mottled siltstone with medium-grains of quartz; discontinuous in the Circle Cliffs area and present as channels cut into the top of the Moenkopi Formation; thickest channels are locally mineralized with uranium, copper, lead, silver, and cobalt; 0 to 30 meters (0-100 ft) thick, thickening westward.

unconformity

TRm **Moenkopi Formation** -- Divided into several unmapped units; in descending order: Moody Canyon Member, Torrey Member, Sinbad Member, and Black Dragon Member in the Circle Cliffs area; Sinbad Member correlates with the Timpoweap Member in the Kaiparowits Basin; Moody Canyon Member is red-brown mudstone and yellow-gray sandstone, dolomite, and dolomitic sandstone forming ledgy slopes and cliffs, 61 to 98 meters (200-320 ft) thick in the Circle Cliffs area; Torrey Member is light-yellow to dark gray sandstone and siltstone, slope-forming with a few ledges; commonly saturated with oil or asphalt, 73 to 94 meters (240-310 ft) thick in the Circle Cliffs area; Sinbad Member is brown and yellow-orange oolitic fossiliferous dolomite and conglomeratic dolomitic sandstone, 0 to 17 meters (0-55 ft) thick; Black Dragon Member consists of white to light-gray fine-grained dolomitic sandstone to sandy dolomite containing abundant fragments of white chert, 0 to 12 meters (0-40 ft) thick. All member

thicknesses are for the Circle Cliffs area; the formation, including the members, generally thicken westward and northward; where drilled through in the Kaiparowits Basin, the Timpoweap (Sinbad) Member is 18 to 21 meters (60-70 ft) thick; the entire Moenkopi Formation thickens from 88 meters (290 ft) in the east to 290 meters (950 ft) in the west.

TRmt Timpoweap Member (shown on figures only)

unconformity

Permian

P **Permian Formations** -- Undivided Kaibab Limestone and White Rim Sandstone as mapped in the Circle Cliffs and undivided Permian units in the subsurface; Kaibab is light-yellow thinbedded oolitic dolomite and thinbedded, fine-grained white calcareous siltstone, containing chert and chert layers in upper part, cliff-forming, 0 to 61 meters (0-200 ft) thick, thickening northward; White Rim Sandstone is thin- to thick-bedded, dolomitic sandstone overlying white cross-bedded fine-grained sandstone with medium- to large-scale cross-beds, incompletely exposed; In the Kaiparowits Basin the Kaibab Limestone is underlain by the Toroweap Formation, Organ Rock Shale, and the Queantoweap or Cedar Mesa Sandstone.

Pwr **White Rim Sandstone** (shown on figures only)

SUBSURFACE UNITS

The following units were penetrated in drill holes in the Upper Valley anticline in the Kaiparowits Basin:

Permian

Pk Kaibab Limestone: 43 to 61 meters (140-200 ft) thick

Pt Toroweap Formation: 110 to 128 meters (360-420 ft) thick.

Organ Rock Shale: 43 to 49 meters (140-160 ft) thick.

Cedar Mesa Sandstone (Queantoweap): 411 to 427 meters (1350-1400 ft) thick.

Pennsylvanian

Hermosa Formation: about 104 meters (340 ft) thick.

Molas Formation: 12 to 21 meters (40-70 ft) thick.

Mississippian

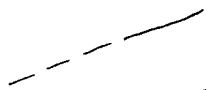
Redwall Limestone: about 274 meters (900 ft) thick.

Devonian: about 119 meters (390 ft) thick.

Cambrian: 30+ meters (100+ ft)

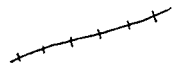
Geologic Map of the Escalante and parts of the Loa and Hite Crossing 30'x60' Quadrangles

Key to Map Symbols

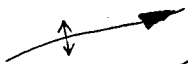


Contact -- dashed where approximately located

Fault -- dashed where inferred or approximately located; dotted where concealed; bar and ball on down-thrown side



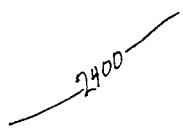
Landslide or slump scarp



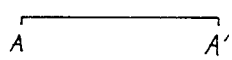
Anticline -- showing axial trace; arrow shows direction of plunge

Syncline -- showing axial trace; arrow shows direction of plunge

Monocline -- line placed on axial trace of upper hinge

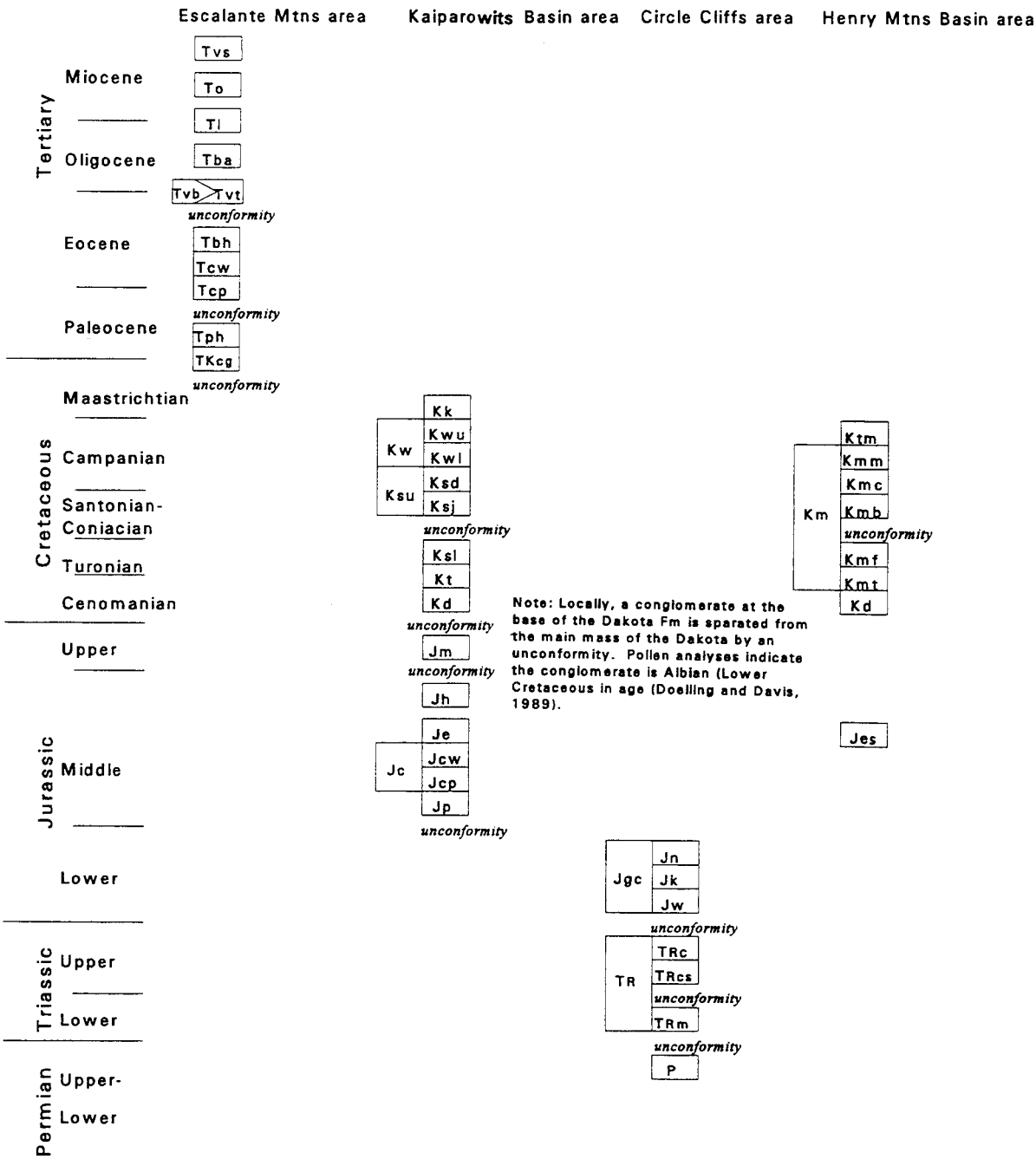


Structural contour -- contour interval 100 meters; intermediate contours shown locally; drawn on top of Permian strata (east part of map area -- separated by dashed line), Navajo Sandstone (central part of map area -- separated by dashed line), lower member of Straight Cliffs Formation (west part of map area -- separated by dashed line)

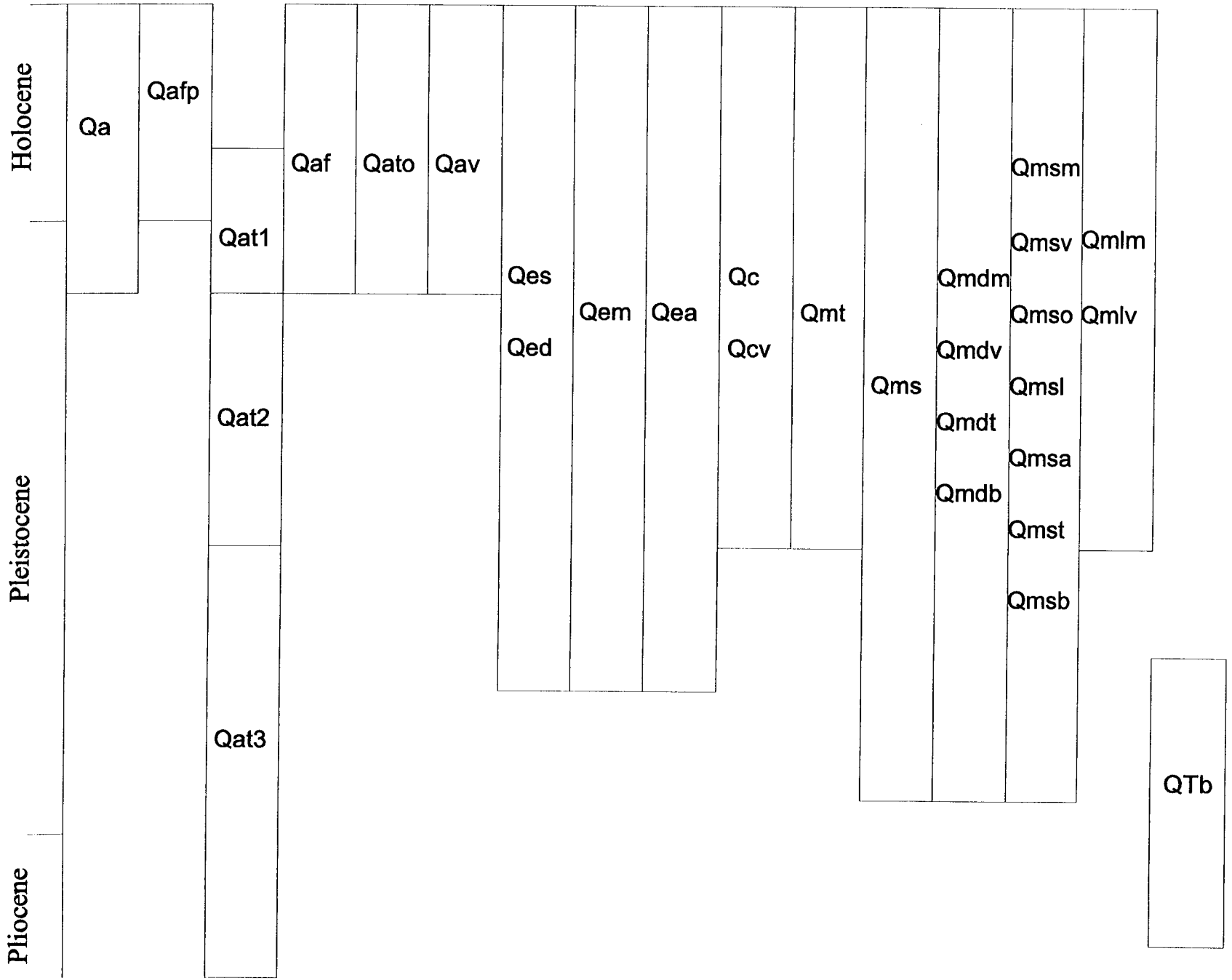


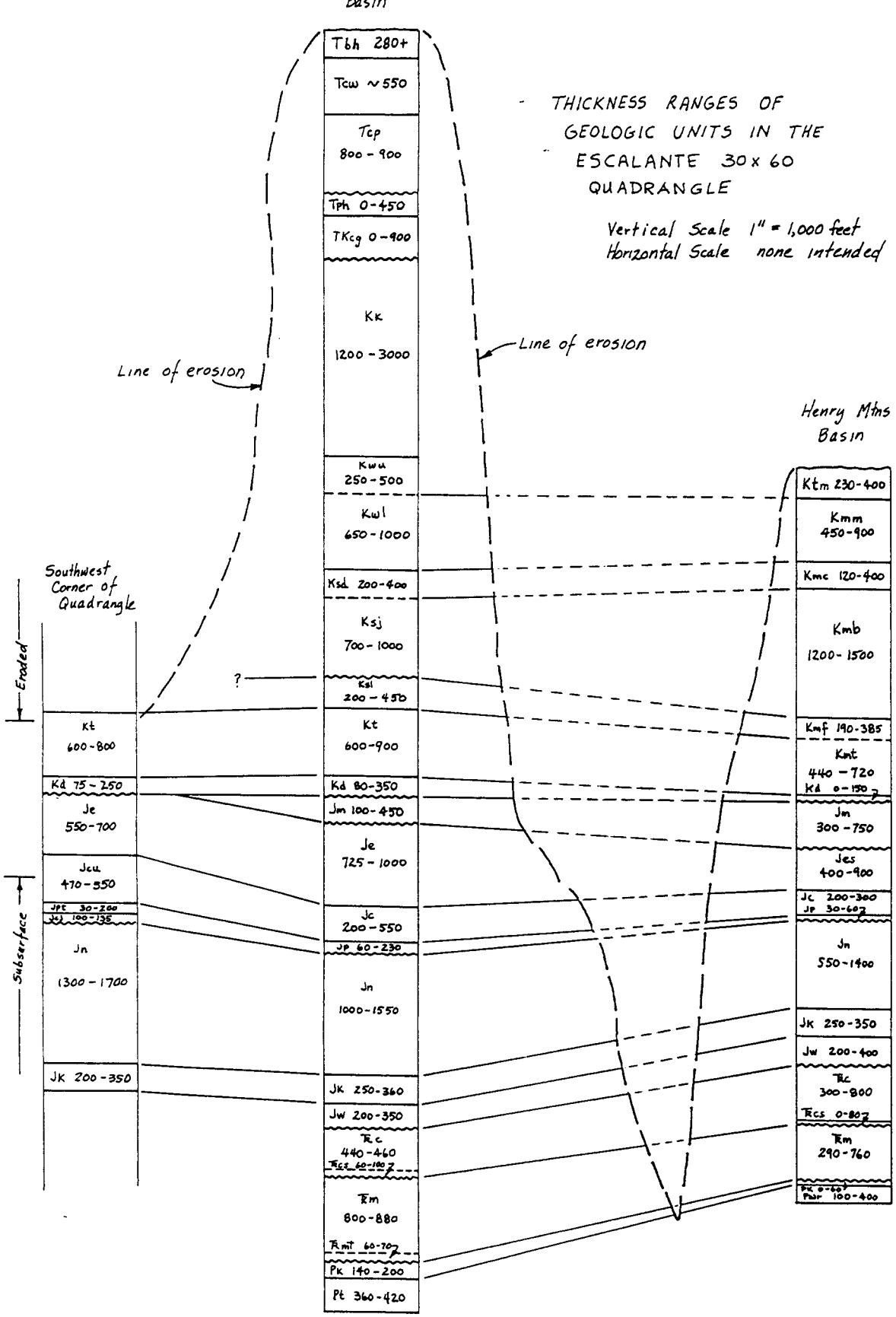
Line of cross section

Correlation of Bedrock Units -- Escalante and parts of Adjacent 30'x60' Quadrangles



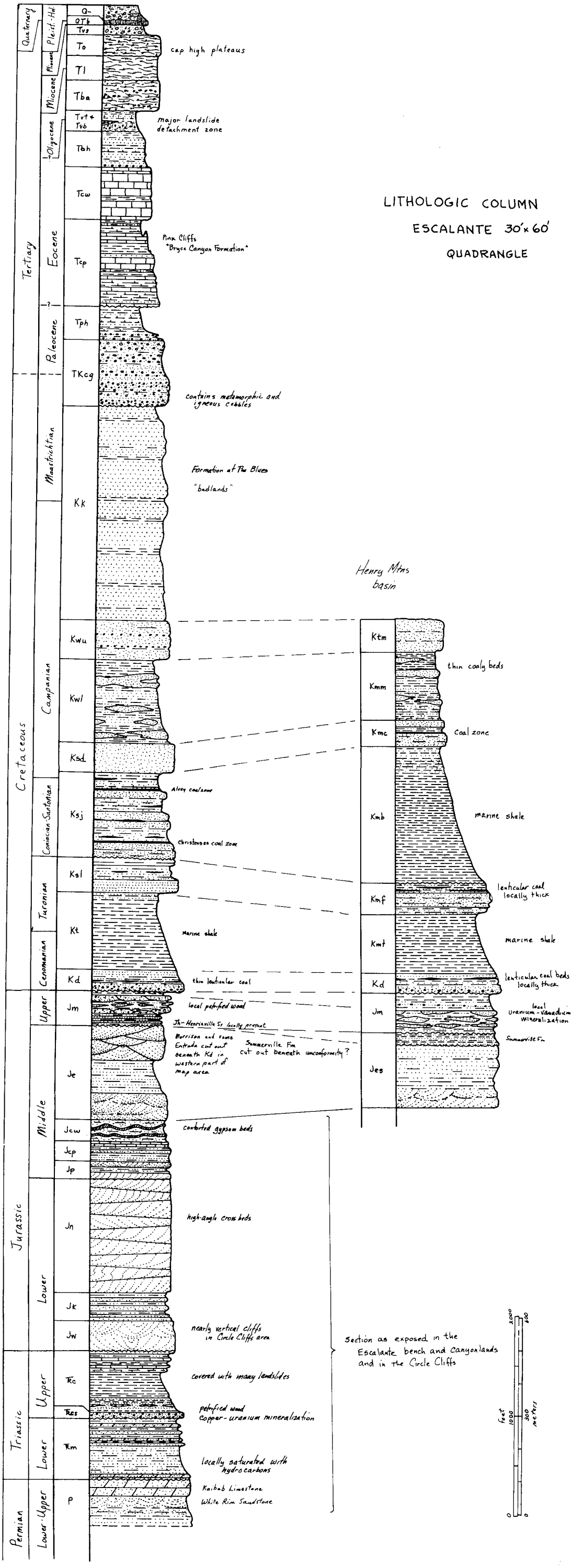
Correlation of Surficial Deposits -- Escalante and parts of Loa and Hite Crossing 30'x60' Quadrangles, Garfield and Kane Counties, Utah

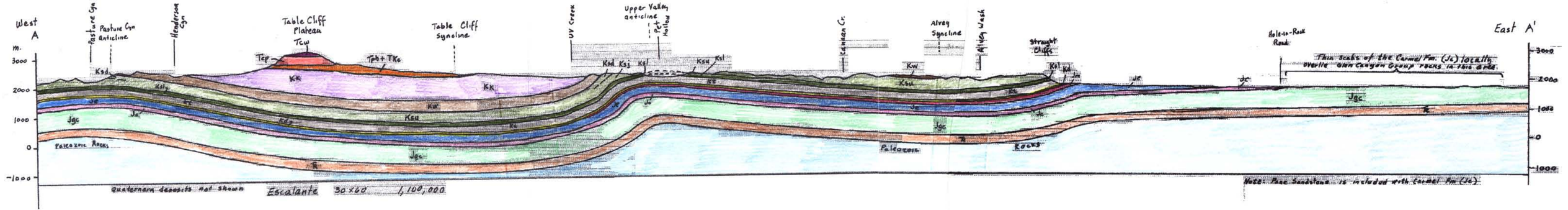




Original
11/4 1999

LITHOLOGIC COLUMN
ESCALANTE 30'x 60'
QUADRANGLE

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Upper Valley anticline
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Kahiwan Cr.
Alvey Syncline
Alvey Wash
Straight Cliffs
Hole-in-Rock Road
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Tpb + Tkc
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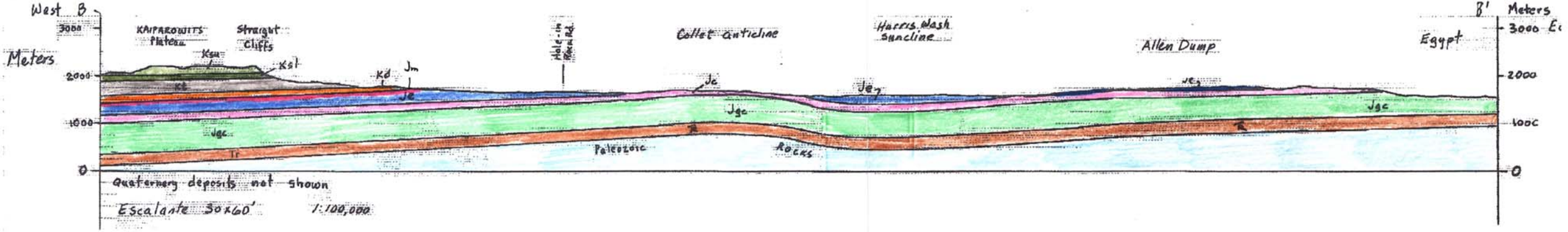
Paleozoic Rocks
Quaternary deposits not shown
Escalante 30 x 60 1,100,000
This scale of the Carmel Fm. (Jc) locally
overlies Glen Canyon Group rocks in this area.
Note Page Sandstone is included with Carmel Fm (Jc)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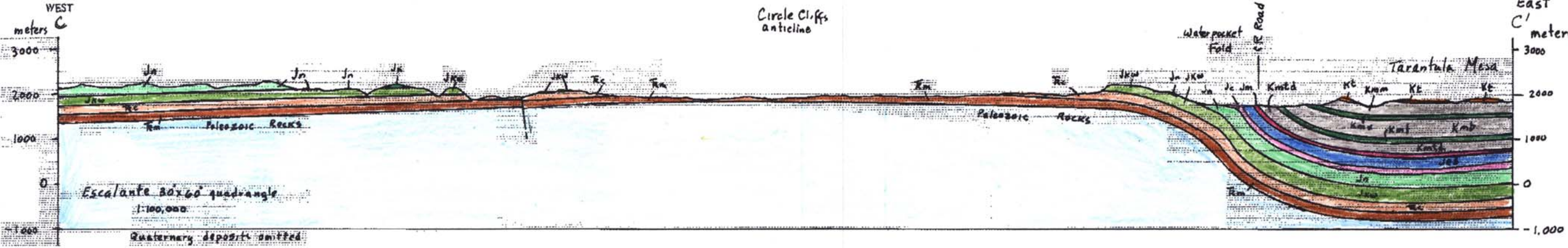
Paleozoic Rocks
Quaternary deposits not shown
Escalante 30x60'
1:100,000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Km
Paleozoic Rocks
Escalante 30'x60' quadrangle
1:100,000
Quaternary deposits omitted